Date: December 4, 2012

Re: Comments on "Final Peer Review Report, External Peer Review of EPA's Draft Document, An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska," September 17, 2012

From: David M. Chambers

The Final Peer Review Report contains a long list of detailed comments from a well-qualified group of experts who participated on the Peer Review Panel. Although most of the comments address issues with which I have only peripheral familiarity, some of the comments address areas in which I am qualified to comment. With some of these comments I have a somewhat different position than that expressed by the Peer Reviewers, and I would like the opportunity to explain why I believe these comments might be interpreted differently.

The comments which I would like to call to your attention are copied in italics below.

Peer Review Report, p. 40:

> *"It is also inconceivable to me that the company will not follow "best mining practices" in the design and development of such a mine."*

In designing and regulating a mine companies and regulatory agencies typically follow some, but by no means all, "best practices". While it is possible that designs in a final mining-permit could be different from initial mine design proposals, it is by no means "inconceivable" that plans will go forward with little or no changes.

For example liners can be considered best practice for tailings ponds. In Alaska lined, or partially lined tailings facilities are utilized at Pogo, Greens Creek, and Nixon Fork. Liners were not required at Red Dog (highly acid generating waste), Rock Creek (cyanide), Fort Knox (cyanide, some neutral drainage contaminants), and Kensington.

There are several examples from the Pebble Project that are illustrative. At the present the Pebble Limited Partnership (PLP) has stated they are not considering a lined tailings pond.[2] A liner at Pebble not likely to be required by state or federal regulatory authorities when permits are considered because of the significant costs involved, and because precedent has not required a liner for tailings ponds for this type of mine either nationally or in Alaska. Red Dog, which would be the closest analog to Pebble in Alaska (base metal mine with potentially acid generating waste), is not required to have a lined tailings pond.

Another example is the design seismic event that is proposed by PLP engineers. Best-practice would be to use the maximum credible earthquake as the design seismic event, but use of a lesser seismic event has been proposed by PLP.[3]

Dam design type is a third example. The best-practice dam design would be downstream-type, but the proposed designs have all been a hybrid centerline-type design.

Finally, PLP has not used best practice during its own exploration. Best practice in mineral exploration drilling would dictate lined pond-sumps for drill cuttings and drill fluids. Not only do drilling muds contain contaminants like barium and hydrocarbons, but the target minerals for exploration are sulfides,

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[2] "A geomembrane face liner will be connected to the plinth and extended up the embankment face." Ghaffari et al., Preliminary Assessment of the Pebble Project, Southwest Alaska, Wardrop-Northern Dynasty Mines, February 17, 2011, p. 356.

[3] "Long Term Risks of Tailings Dam Failure," David M Chambers and Bretwood Higman, October, 2011

which when brought to the oxidizing environment at the surface pose a danger of heavy metal contamination. Lined drill sumps are not being utilized for the exploration drilling at Pebble, the largest exploration project in Alaska, which now constitutes over 1000 holes.[4]

Frankly, to claim that best-practice design would always be followed by either mine designers or by regulators is not realistic.

Peer Review Report, p. 40:

> *"Filtered dry stack tailings can be considered as a realistic option, even for mines with higher production rates."*

Dry stack are very unlikely to be proposed by the developer at Pebble because of the significant increase in cost associated with this tailings placement method. I am not aware of a single example in a regulatory jurisdiction where the regulatory agency has required a mine developer to use dry stack tailings.

Peer Review Report, p. 40:

> *"Flotation of remaining sulfides in the tailings before deposition is also a realistic option for mines; it has been done successfully at the Thompson Creek Mine in Idaho for the last 18 plus years."*

Pyrite flotation of is certainly technologically viable, but is another example of a best-practice that is seldom done at mines, almost always because of the additional cost involved.

Pyrite floatation is being utilized at Thompson Creek because the cycloned tailings sands used to construct early stages of the dam also concentrated pyrite in the coarse sand fraction, and have already caused an intractable long term acid generation problem. A pyrite floatation circuit was later installed so that the coarse sand fraction of the tailings could continue to be used for dam construction after the pyrite is removed. At this point in time there really is no other alternative for dam construction material. And, even with 'clean' sands on top of the contaminated sand material used for the initial stages of dam construction, there will still be a long term acid generation problem because the sands affected must remain unsaturated (and exposed to oxygen) to insure the long term seismic stability of the dam.

Peer Review Report, p. 49:

> *"If the mining company is still managing the site, then they will have responsibilities under all Federal and State Regulations and the dire picture painted by the EPA Assessment should not come to pass."*

Organizational 'responsibility' for a large mining project is often a problematic management assignment. Metal prices rise and fall; mining companies are bought, sold, and merged; mines change hands. Companies provide bonds to the State to ensure mine closure will occur if there is a bankruptcy. Bonding may or may not be sufficient to close a mine. As of 2012 Alaska has 10 operating, proposed, or closed large mines (Pebble, Donlin, Fort Knox, Red Dog, Greens Creek, Kensington, Pogo, Nixon Fork, Rock Creek, and Illinois Creek mines). Of these one closed before reaching actual operating status (Rock Creek), and one went into bankruptcy with inadequate bonding to cover mine closure (Illinois Creek).

To put it another way, 20% of Alaska large mines have closed prematurely, and 10% have gone into bankruptcy with inadequate reclamation & closure bonding. While Alaska bond calculation procedures have been updated, it would not be prudent to presume that a bankruptcy with accompanying bond deficiencies could never happen again.

[4] "Water Quality at Pebble Prospect Drill Rig #6, South Fork Koktuli River, Bristol Bay, Alaska, 22-23 Oct. 2011," Woody, et. al., Final report July 9, 2012.

Peer Review Report, p. 80:

> *"If the concentrate (due to a pipeline spill) is submerged under water in relatively slow flowing streams then very little long-term release of the copper will occur, as the water does not contain sufficient oxygen to allow for sulfide oxidation."*

This statement is not supported by fact. It is well known that sulfide minerals moving as sediment downstream channels creates significant contamination problems when that material is mobilized and exposed due to normal fluvial processes. For example, low flow, even in a slow moving stream, could periodically expose sulfide minerals to oxidation, and the salts would be mobilized during the next storm event, spring freshet, etc. These systems are dynamic, subject to freeze-thaw conditions and fluctuating volumes and flows.

Peer Review Report, p. 81:

> *"Because of the dire consequences of a failure in this highly sensitive and unique environment, it would be necessary to employ state of the art methods for tailings management and go 'beyond compliance' when designing and constructing this facility. This may include employing methods that are novel, incur significant additional cost for construction, and lead to a more stable and lower maintenance facility in the long term, such as dry stack or paste rock tailings (blending waste rock in with tailings in the impoundment to provide extra geotechnical stability)."*

Dry stack tailings could provide additional geotechnical stability, paste tailings would not. In order to gain "additional" geotechnical stability, the tailings would require mechanical compaction. Without compaction the tailings are still subject to resaturation and mobilization under seismic loading or an uncontrolled hydrologic event.

The primary use of paste tailings has been in underground mining backfill, although in the past decade paste tailings have been more widely utilized in surface mining operations. The primary advantage of paste tailings is the recycling/recovery of process water, which will not be of significant relevance at Pebble.[5] Paste tailings do not have the inherent structural advantages of dry-compacted tailings.

To date the PLP has discussed only conventional tailings disposal behind a tailings dam. Use of "state-of-the-art methods" have seldom been required by a regulatory agency for an Alaska mine, and would likely be incorporated only if recommended by the mine proponent – which is not the case to date at Pebble.

Peer Review Report, pp. 81-82:

> *"The assessment deemed that it was "not possible" to determine how far the initial slurry deposition would extend, how far re-suspended sediments would travel, and how long erosion processes would continue. It seems that information from other mine closure sites could be used by assessment authors to infer effect by analogy. The statement alluding to potential sediment run out distance at the bottom of page 4-56 of the main report should be included in the summary of effects. This is an important point."*

There is good empirical information on tailings runout distance in: Rico et. al., "Floods from tailings dam failures, Journal of Hazardous Materials, 2008." See Figures 2 & 3 on Rico, page 82.

Peer Review Report, pp. 84:

> *"A significant improvement in tailings management is the implementation of an Independent Tailings Dam Review Board (ITRB) for large mining projects (Morgenstern, 2010). ... I expect that a tailings review board will also be used for the Pebble Mine and the behavior of a tailings management facility*

[5] "Paste: A Maturing Technology," Simon Walker, Engineering & Mining Journal Features, European Editor, downloaded at http://www.e-mj.com/index.php/features/1151-paste-a-maturing-technology, Nov12

designed and operated under these conditions will be more representative of the potential failure likelihoods expected for such a facility."

Unfortunately there is no requirement, hence no guarantee, that an independent review board will be utilized for tailings management oversight at Pebble. Regardless, Pebble is not the only mine that is likely for the Bristol Bay region if the Pebble mine is constructed, since the transportation infrastructure that would accompany Pebble could facilitate the development of additional mines in the area. It is likely these secondary mines would not face the same level of scrutiny that Pebble would.

In addition, even with regulatory oversight there are many examples of the dam construction-type changing in later stages of a mining project. This is perfectly illustrated by the Fort Knox Mine in Alaska where the all but the final stage of tailings dam construction was downstream. However, the final dam lift is upstream - the type of construction most susceptible to seismic instability.

Peer Review Report, pp. 84:

"I would consider the assumption that a release of 20% of the tailings material for the Pebble mine scenario is on the high side, even during operations."

Data presented in "Floods from tailings dam failures," M. Rico, G. Benito, A. D´ıez-Herrero, Journal of Hazardous Materials, 2008" would support the interpretation that approximately 20% would be an "average" value for tailings release during a tailings dam failure (see Rico, Figure 4, p. 83).

Note that the information presented in the Rico paper is based on actual tailings dam failure data.

Peer Review Report, pp. 84:

"In the case of the Aznalcóllar Tailings Dam failure in Spain, all the released tailings downstream of the mine were removed. While such a removal action will impact parts of the watershed, it will help to recover the area faster than leaving all the tailings in place and will also reduce the longer-term impacts on downstream water quality. I therefore disagree with the assumption on p. 6-2 that "the assessment assumes that significant amounts of tailings would remain in the receiving watershed for some time and remediation may not occur at all."

Data on the success of tailings spill cleanup is lacking. It was estimated by Boliden, the company that owned the failed dam, that 97-98% of the spilled tailings were recovered in the cleanup.[6] However, it was also noted that "The clean-up left a completely barren landscape without ground vegetation, except for some large trees that could be saved."[7]

Tailings cleanup in the Pebble area that requires a "completely barren landscape without ground vegetation" would likely pose a different set of problems in southwest Alaska than those in Spain, where there is an existing road system that could be used for cleanup access, and where the climate is much warmer and dryer.

Peer Review Report, pp. 84-85:

"Box 6-1 provides "background on relevant analogous tailings spill sites" and three historic sites are used as analogs. These are not realistic analogs, as they all relate to historic mining under completely different scenarios. While the material historically released in these streams were from base metal mines, the circumstances of their release, especially in the case of the Clark Fork and the Coeur

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[6] "The tailings pond failure at the Aznalcóllar mine, Spain," N. Eriksson, Boliden Environmental Staff, Aznalcóllar, Spain, P. Adamek, Mine Environmental Consultant, Sevilla, Spain, Paper prepared for the Sixth International Symposium in Environmental Issues and Waste Management in Energy and Mineral Production, Calgary, Alberta, Canada, 30 May – 2 June, 2000, p. 6.

[7] Ibid, p. 4.

> *D'Alene Rivers, were very different. Long-term uncontrolled releases occurred in these river systems due to regulatory circumstances or historically acceptable practices that differ significantly from those in the 21st Century."*

Although the release mechanisms for the Clark Fork and Coeur d'Alene Rivers are different than for a tailings dam failure, the issue at hand is not the release mechanism, but:

(1) how the material released affected aquatic organisms in the river; and,
(2) how difficult, and whether, a cleanup of this released material was possible.

The examples utilized in the Watershed Assessment address these critical issues, and to ignore the lessons available from these examples, even though the release mechanism is different, would be irresponsible.

Thank you for the opportunity to comment on this report.

Sincerely:

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